SOUNDING-BALLOON RELEASING DEVICE

By L. T. Samuels

A very satisfactory device has been designed by Mr. Berlin Pugh, of the Royal Center aerological station, which permits the balloon, after bursting, to detach itself

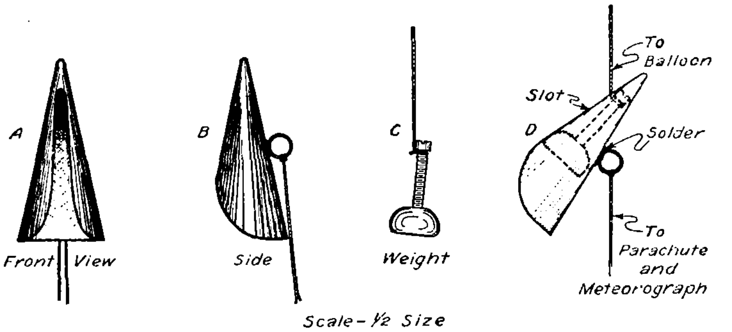

FIGURE 1.—Device for releasing parachute and meteorograph from sounding balloon after latter bursts

from the parachute and meteorograph. This results in a much more satisfactory rate of descent of the instrument and consequently a more accurate record.

This device is shown in Figure 1 and consists of two parts, one, an aluminum slotted cone and the other, a brass weight. In Figure 1 *d* is shown how the two parts are used in an observation. One end of a cord is tied to the brass weight and the other end to the balloon. The brass weight is held inside the cone by the upward pull of the balloon. When the latter bursts, the brass weight slips out of the cone and the parachute is then free to operate during the descent of the instrument. A small wad of paper is put into the pointed end of the cone to prevent the brass knob from sticking.

The parachute used by the Weather Bureau is simply a square yard of bright red China silk. Cords are fastened to each corner and to the center. The other end of the cord attached to the center of the parachute is fastened to the aluminum cone. A light wire hoop about 1 foot in diameter is tied to the four cords attached to the corners of the parachute and prevents them from tangling and assures the opening of the parachute.

These devices were used with excellent results during a sounding balloon series at Royal Center, Ind., during February, the international month for 1931.

PYRANOMETER RECORDS ASSIST IN DISTINGUISHING BETWEEN HAZE AND CLOUDS

By A. F. Gorton, Associate in Meteorology, and S. W. Chambers, Associate in Physical Oceanography

[Scripps Institution of Oceanography, La Jolla, Calif.]

The thermoelectric pyranometer[1] has a decided advantage over the standard Friez Weather Bureau sunshine recorder in that the record is strictly numerical or quantitative. The extreme range of the Engelhard recorder in use at the Scripps Institution of Oceanography, La Jolla, Calif., is 0–30 microamperes.[2] The maximum value for clear skies is a little over 20 microamperes (66.7 scale divisions) attained in June. Momentary readings as high as 25 microamperes (82.5 scale divisions) have been observed, due to radiation reflected from broken clouds. During the winter season lower values are reached, the record running between 12.5 and 13 (about 42 scale divisions) in the middle of the day, with clear skies.

The Kimball-Hobbs pyranometer at La Jolla has been functioning continuously for over two years, and a summary of the data has been published in the Monthly Weather Review each month. In reviewing the accumulation of daily charts, the writers have been impressed by the fact that they apparently enable one to distinguish between days marked by *haze* and those marked by *scattered* or *continuous clouds* of considerable density, including "high fog."

Accompanying this note are sample charts which illustrate quite clearly the point in question; i. e., that the instrument easily distinguishes between what we may term "vapor," filmy cloud such as light cirrus, and clouds of material density. To be specific, that portion of the record of an apparently flawless day which is marked by a solid but jiggly line is due to what we have here called "vapor." This vapor or haze is often absolutely invisible to the eye. On the other hand, when scattered clouds of more or less density are present, the record jumps very erratically, changing as much as 4 to 8 microamperes in a few minutes' time. Furthermore, on days marked by dense cloud and rain, it is noticed that the line traced by the instrument is rather continuous but lies close to zero—in fact, the intensity may be six, four, or even less, scale divisions,[3] as is well shown by the records for May 5 and 16, reproduced in Figures 1–A and 2, respectively.

As previously stated, the instrument responds to scattered clouds by fluctuating between wide limits (figs. 1–B and 3), and on very bright, clear days makes a trace which is quite solid, i. e., *continuous*, but varies as much as 5 or 6 per cent during time intervals as short as 10 to 20 minutes. As illustrations of this point we cite the records for the afternoon of May 5 and 22, Figures 1–C and 4, respectively.

Finally, we have noticed another peculiarity of the instrument; that is, a tendency when scattered clouds are present for the record to exceed by as much as 2 to 3 microamperes the very maximum for a normal clear day. (See records for May 5 and 28, reproduced in Figures 1–B and 3, respectively.)

It is recognized, of course, that various types of haze, fog, and cloud exist, and here on the Pacific coast it is often difficult to distinguish precisely between them. We have observed, however, that variations of as much as 5 microamperes may be caused by what most people term "high

[1] Kimball, Herbert H. and Hobbs, Hermann E.: A new form of thermoelectric recording pyrheliometer. Monthly Weather Review, May, 1923, vol. 51, p. 239.

[2] It would be preferable to state the output of the thermocouple system in millivolts, but the latter may be calculated from the relation: E. M. F. in microvolts=412×current in microamperes. To reduce microamperes to gram-calories per minute per square centimeter, multiply by 0.055. Thus, 30 microamperes equals 1.65 gr.-cal./min./cm^2, and 20 microamperes equals 1.10 gr.-cal./min./cm^2. Also, scale readings on the record sheet may be reduced to gr.-cal./min./cm^2 by multiplying by 0.0165. A recent test by the Scripps Institution shows that the register has not changed in the three years it has been in service.

[3] Kimball, Herbert H.: Records of Total Solar Radiation Intensity and Their Relation to Daylight Intensity. Monthly Weather Review, October, 1924, vol. 52, p. 473, fig. 5.

(To face p. 76)

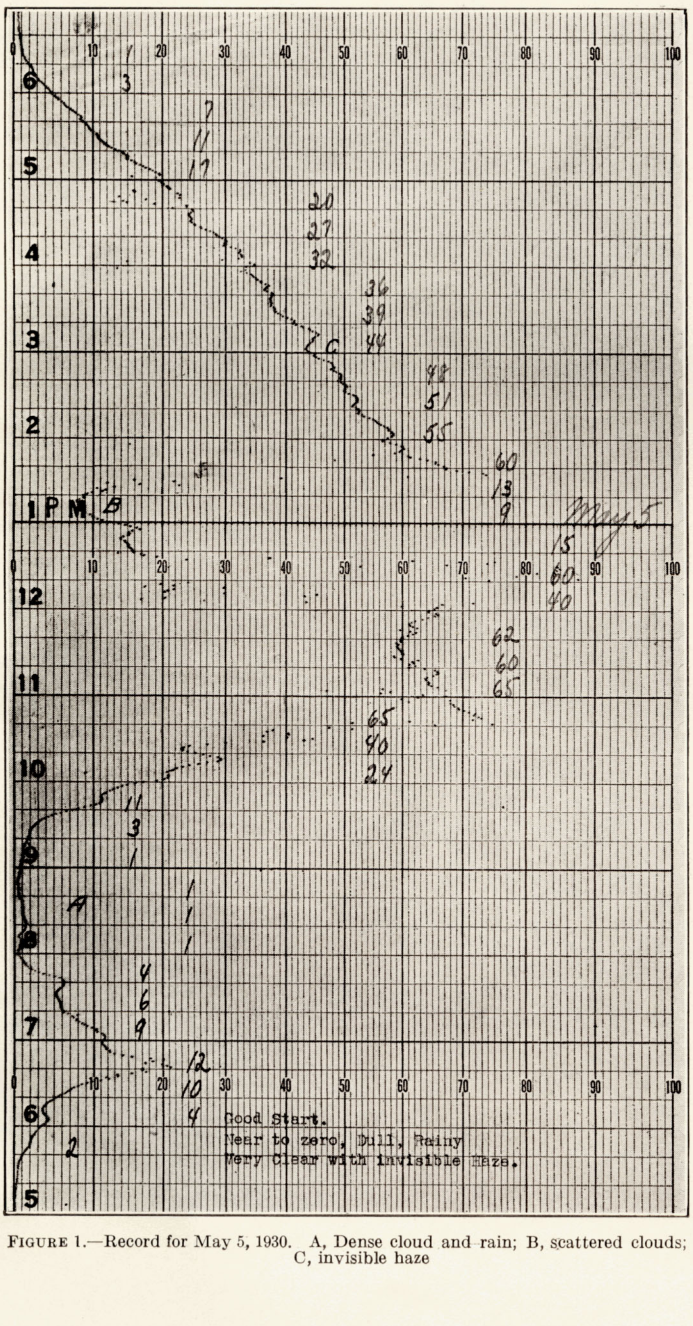

FIGURE 1.—Record for May 5, 1930. A, Dense cloud and rain; B, scattered clouds; C, invisible haze

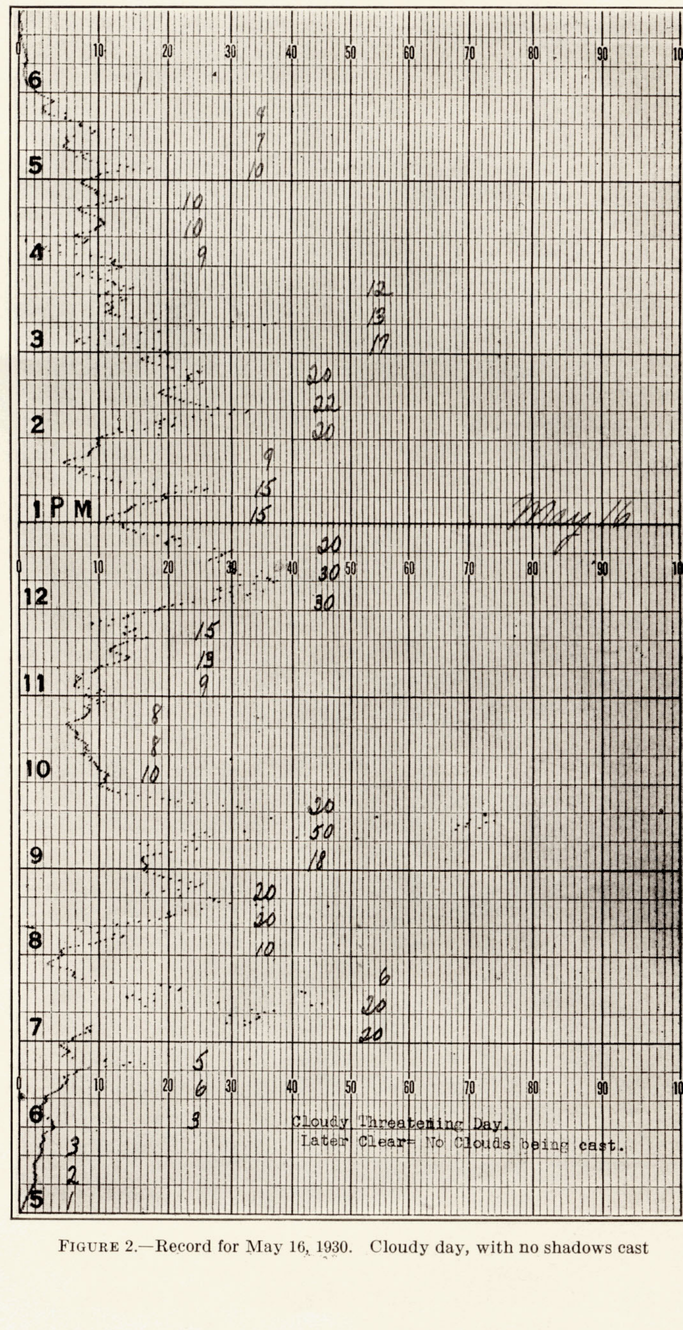

FIGURE 2.—Record for May 16, 1930. Cloudy day, with no shadows cast

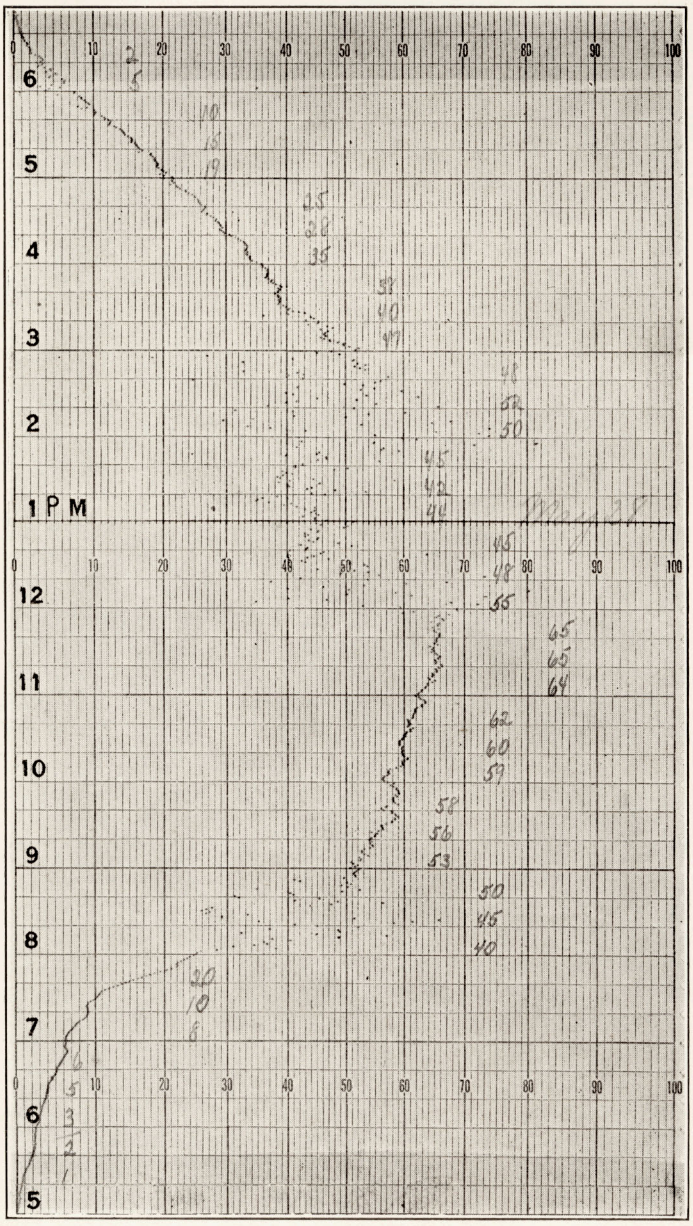

FIGURE 3.—Record for May 28, 1930. High fog

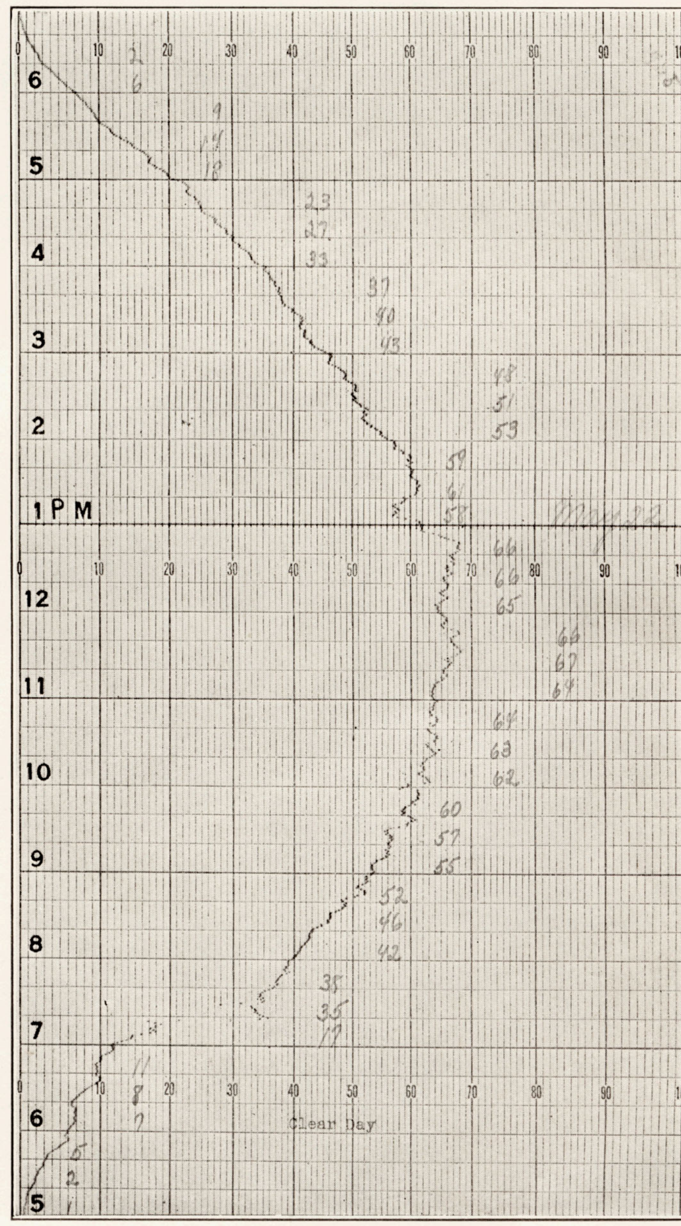

FIGURE 4.—Record for May 22, 1930. Invisible haze

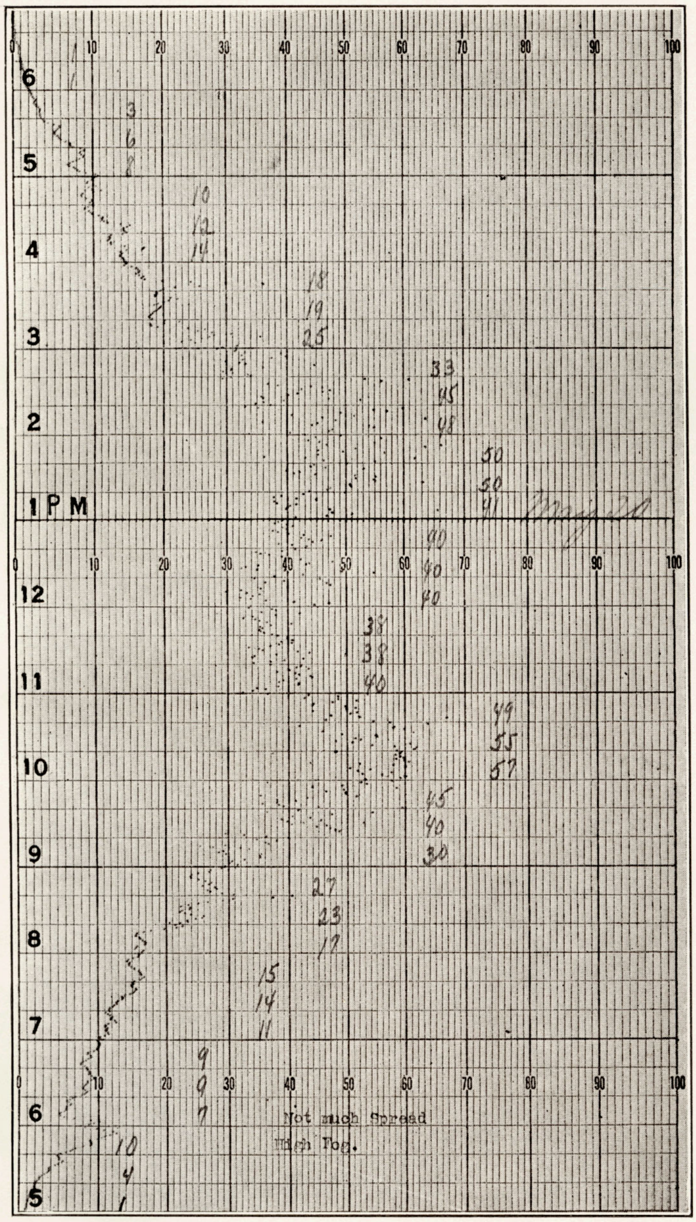

FIGURE 5.—Record for May 20, 1930. High fog

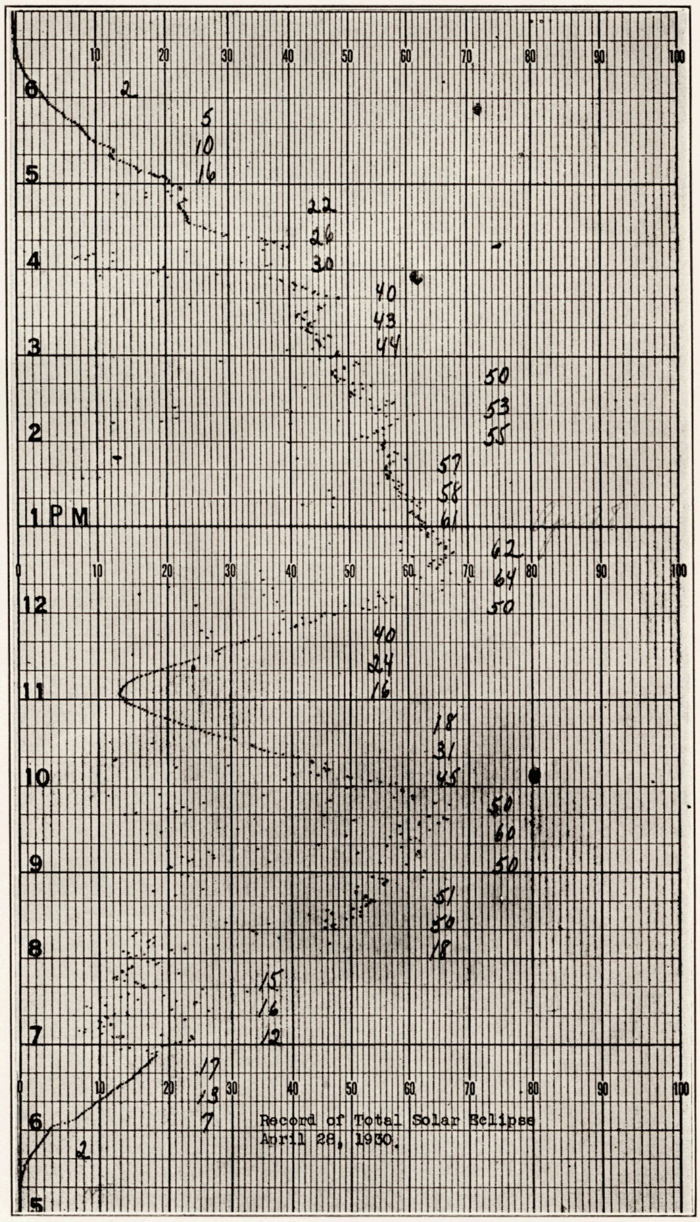

FIGURE 6.—Solar eclipse of April 28, 1930

fog." This term should be applied to cloud banks of considerable continuity and density,[4] and not confused with cirrus (high altitude) clouds or with ordinary "low fog."

Possibly we may establish a safer criterion by determining whether a shadow is being cast. We have observed that in some cases the record varies over 5 microamperes, but the total intensity is not much reduced below the maximum for a clear day. In these cases it was noticed that shadows were cast. On the other hand, when the cloud density increases sufficiently a shadow is no longer cast and the record sinks to 6 microamperes or less. As an illustration of some of these points we may cite the record for the day of the total solar eclipse, April 28, 1930. (See fig. 7.) Here it will be noticed that the trace becomes quite continuous below 12 microamperes (40 on the chart) having the smoothness of a record for a clear day but forming a beautiful V-shaped indentation in the record.

Kimball,[3] in several articles dealing with the design, construction, and performance of the pyranometer, refers to irregularities in the traces of the instrument on apparently clear days but comes to no definite decision regarding the probable cause of the irregularities. On another occasion he states that they may be caused by smoke. At a location like La Jolla, this hypothesis is ruled out, since the atmosphere is always smoke-free except on rare occasions when there are forest fires.

[4] See Carpenter, Ford A.: The Climate and Weather of San Diego. 1913, pp. 5–7.

[3] Kimball, Herbert H.: Records of Total Solar Radiation Intensity and Their Relation to Daylight Intensity. MONTHLY WEATHER REVIEW, October, 1924, vol. 52, p. 473, fig. 5.

SOME CHARACTERISTICS OF CONTINUOUS RECORDS OF THE TOTAL SOLAR RADIATION (DIRECT+DIFFUSE) RECEIVED ON A HORIZONTAL SURFACE

By HERBERT H. KIMBALL

In the paper preceding this, Gorton and Chambers have pointed out some interesting relations between the character of solar radiation records and the condition of the sky. Ångström [1] has already noted some of these relations at Stockholm, and especially the increased intensity with the sun shining between broken clouds.

In an earlier paper entitled "On Continuous Radiation Records and Their Bearing upon Geophysical Problems." (Särtryck ur Förhandlingar 17: de skandinaviska naturforskaremötet i Götchorg, 1923) he discusses the cloud formation during the passage of a cold-wave front at Stockholm on August 4, 1922. The formation of a uniform cloud layer preceded the arrival of the cold air at the surface by an appreciable time interval, and breaks occur in this cloud layer at uniform intervals of two hours. This is explained as follows:

> The upper boundary of the cold wave is in general subjected to a pronounced wave formation. Sometimes waves of higher orders are well developed. As a rule the uniform cloud layer appears at the wave tops, the breaches in the cloud layer at the valleys, but exceptions therefrom sometimes occur. In the special case referred to above the breaches in the cloud layer have occurred almost exactly at the lowest points of the waves.

Apparently, atmospheric waves sometimes occur without forming visible clouds. For example, in the MONTHLY WEATHER REVIEW for September, 1915, volume 43, page 441, in Figure 1 are plotted logarithms of solar radiation intensity against air mass, measured on unusually clear days. With a sky of uniform clearness throughout, the plotted values should fall on a line only slightly concave upwards. Actually, however, the values fall on a wavy line, and especially those for Washington, during the afternoon of February 28, 1915, and for Mount Weather, Va., during the morning of September 28, 1914.

Attention has also been called to the effect of smoke on the solar radiation intensity. See, for example, MONTHLY WEATHER REVIEW, volume 52, page 478, Figure 5, October, 1924, and volume 53, page 147, Figure 1, April, 1925. The first of these reproduces records of intensity of the total solar radiation received on a horizontal surface at the university station, Chicago, Ill., and its depletion by smoke on both a cloudless and a cloudy day. The second shows the depletion of direct solar radiation intensity at normal incidence at the American University, District of Columbia, by a smoke cloud that was brought over the university from the city by an east wind. Clouds of less density frequently cause depressions in the records obtained in the vicinity of any city.

It is apparent that much valuable information about sky conditions may be obtained from continuous records of the intensity of solar radiation as received on either a horizontal surface or on a surface normal to the incident rays.

[1] Ångström, Anders. Recording solar radiation. Medd. Från Statens Meteorologisk-Hydrografiska Anstalt, Band 4, No. 3, 1928.

COMPARISON OF ROOF AND GROUND EXPOSURE OF THERMOMETERS

By BERNARD R. LASKOWSKI

[Weather Bureau, Topeka, Kans.]

It is generally conceded that the average temperature readings obtained from properly exposed thermometers in the Plains States, where the ground surface is level or slightly rolling, agree quite closely within a radius of from 15 to 25 miles. What, however, is the relation between official temperatures taken in downtown sections of middle-western cities and their suburbs? In other words, do official temperatures taken on high buildings of cities reflect conditions under which people live in the residence sections? It must be remembered that in a great percentage of the larger cities the usual practice is to locate the thermometers on roofs of high buildings, while in the suburbs, the thermometers are more likely to be exposed over a ground surface. In order to investigate this question a 6-year record of daily maximum and minimum temperature readings was obtained in Topeka, Kans.

The thermometers used in this study were of standard pattern, compared for accuracy, and exposed in standard shelters having louvered sides and double-decked roofs. These favor the free circulation of the passing air, but do not absorb any added heat due to radiation or reflection from near-by objects or from the direct rays of the sun. One set, that of the Weather Bureau office, was